EFFICIENCY ASSESSMENT OF AGRICULTURAL LAND USE IN CON CUONG DISTRICT, NGHE AN PROVINCE

Nguyen Minh Thanh[1], Nguyen Thi Bich Phuong[2], Bui Nhat Hung[3]
[1,2,3]*Vietnam National University of Forestry*

SUMMARY

Sustainable, economical and effective land use has become an important global strategy. The agricultural land use strategy plays an important role in rural Vietnam as it decides the creation of agricultural and commodity agricultural products as well as the great impact on local people livelihoods. Research results in three communes in Con Cuong district, Nghe An province show that agricultural land use types have been transforming strongly towards sustainable and efficient land use. Research has shown that there are five main Land Use Types (LUTs) in the district. In particular, medicinal plant LUT and orange type V_2 bring the highest economic efficiency, environmental and social benefits. Purely agricultural models (rice, maize) do not give highly economical value but play a necessary role in maintaining traditional farming practices and ensuring food security for local people. Research results are a momentous basis for proposing the direction and use of agricultural land with high efficiency and sustainability for the locality.

Keywords: Con Cuong, economic efficiency, land use strategies, land use types, medicinal plants.

I. INTRODUCTION

Agricultural production creates the main source of agricultural products for consumers, creates jobs for rural labour sources and brings regular incomes to farmers (Nguyen Van Sanh, 2009). An effective and sustainable land use strategies contribute significantly to the economical use of land resources (Le Thai Bat, 2007), the development of ecological agriculture and the sustainable development of country (Dang Kim Son, Tran Cong Thang, 2001). In recent years, with the rapid development of science and technology and the application of biotechnology in agriculture, the use of agricultural land has changed dramatically from pureness to commodity (Do Van Nha, Nguyen Thi Phong Thu, 2016) which brings great benefits to consumers and producers. The economic, environmental and social benefits of land use models are a significant basis for planning effective use of agricultural land (Nguyen Khac Viet Ba et al., 2016).

Con Cuong is a mountainous district in the southwest of Nghe An province, with a total natural land area of 173,831.12 ha, in which agricultural and forestry land areas occupy 164,209.15 ha, accounting for 94.46% of total natural area. Over the past years, agricultural production in Con Cuong district beheld new developments with increasing value of agricultural production, diversified types of plants and animals, agricultural structure shifted towards increasing products of medicinal plants and forest trees with high economic value.

However, agricultural production still has the characteristics of small, fragmented and inefficient production leading to waste of natural resources for agro-forestry development in the area (District People's Committee Con Cuong, 2015).

The main reason is that there are no specific studies on the efficiency of LUTs in the district. Therefore, the paper's objective is to assess the current status of agricultural land use types in

the studied area. The paper focuses on: (i) analyzing current status of agricultural land use types and agro-forestry models in Con Cuong district, Nghe An province, (ii) assessing efficiency of the main agricultural land use types in Con Cuong district; Nghe An province in terms of economic efficiency, environmental and social benefits; (iii) assessing the overall effectiveness and proposing effective LUT. Research results will be essential basis for proposing strategic and effective use for land resources in Con Cuong district, Nghe An province.

II. RESEARCH METHODOLOGY

2.1. Data collection

2.1.1. Secondary data collection

Secondary data include: natural conditions, socio-economic conditions, prices and markets for agricultural commodities in the period between 2011 and 2016. These data are inherited from the Office of People's Councils and People's Committees, the Division of Natural Resources and Environment, the Department of Agriculture and Rural Development.

Secondary data is confirmed by interviewing local officials. The total number of interviewed officials was 9 in 3 studied communes by orientation interview tables.

2.1.2. Primary data collection

a) Describing the current land use status and identifying common LUTs

Data on current land use status and LUTs identification in studied areas were collected by using Participatory Rural Appraisal (PRA) tool. Selected households were interviewed based on preliminary survey results. These households were divided into three groups: rich, middle and poor. 10 households were interviewed in each commune and the total number of interviewed households was 30 households for this item.

Interviewed content is collected in terms of agro-forestry production information including: planting cost, productivity, agricultural income from each LUT.

b) Analyzing principal cropping patterns and common LUTs

PRA tools were applied to interview households directly for collecting information about: crop structure, planting time, applied technical measures, investment capital, productivity, price, revenue and number of labourers.

Transect survey method was used for detailed evaluation of LUTs. The route and number of selected transects are based on current land use status of each commune. This step is supported by representative officials from commune and village. Data of each section was collected about: natural features (land, water source, land use history), main plant species (planting techniques, productivity), and difficulties as well as desires of households.

2.2. Data analysis

2.2.1. Economical efficiency assessment

a) Static methodology

Static method (benefit calculation) was used to evaluate economical efficiency of crops less than 12 months including: Solanum procumbens, Gymnema sylvestre, Lonicera japonica, Rice + Maize hybrids and Rice. The total profit of a LUT is calculated by using the following formula:

$$P = B - C$$

Where: P is total benefit of one LUT in 1 year (VND); B is income value of 1 year (VND); C is cost value of 1 year (VND).

b) Dynamic methodology

Dynamic methods (NPV, CPV, BPV, IRR calculation) were used to assess economic efficiency for long-term crop cycles such as Orange type V_2 (10 years cycles) and Acacia mangium (7 years cycles).

* Net Present Value (NPV):

$$NPV = \sum_{t=0}^{n} \frac{B_t \quad C_t}{(1 + r)^t}$$

Where: Bt: Income value of the t year (VND);

Ct: Cost value of the t year (VND);

r: Interest rate (%);

t: Time of production (years);

Σ: The present value of the net income from year 0 to year n;

n: Years of production cycle.

* Benefit to Cost Ratio (BCR):

$$BCR = \frac{\sum_{t=0}^{n} \frac{B_t}{(1+r)^t}}{\sum_{i=0}^{n} \frac{C_t}{(1+r)^t}} = \frac{BPV}{CPV}$$

Where: BCR: ratio between income and expenses (VND/VND);

BPV: present value of income (VND);

CPV: present value of cost (VND).

* Internal Rate of Return (IRR):

IRR is the discount rate, this rate makes NPV = 0 when $\sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)^t} = 0$ therefore r = IRR.

2.2.2. Social benefits

Social benefits were assessed for both short-term crops (Rice, Hybrid maize, Solanum procumbens, Gymnema sylvestre, Lonicera japonica) and long-term crops (Orange type V_2, Acacia mangium).

The social benefit of LUTs were assessed by PRA tools which interviewed 60 households and 30 staffs of village and commune on the following indicators: (i) ensuring food security, increasing the benefits of farmers people; (ii) meeting the regional economic development strategy; (iii) attracting more labours to solve the employment; (iv) contributing to the transfer of scientific and technological advances and (v) enhancing commodity products, especially exports. Results are evaluated by scoring method, highest is 10 and lowest is 1 point.

2.2.3. Environmental benefits

The environmental benefit of LUTs focuses on assessing the suitability of the cropping system for soil characteristics, the ability to improve and protect the soil such as cover index, organic matter, soil erosion reduction... by scoring method based on the experience of the local people. Environmental benefits were evaluated for all LUTs.

2.2.4. Overall efficiency assessment

The overall efficiency index (Ect) is calculated for all LUTs by using the method of W. Rola (1994):

$$Ect = \left[\left(\frac{f_1}{f_{max}} \text{ or } \frac{f_{min}}{f_1} \right) + ... + \left(\frac{f_n}{f_{max}} \text{ or } \frac{f_{min}}{f_n} \right) \times \frac{1}{n} \right]$$

Where: Ect is the overall efficiency index. If Ect = 1, the LUTs have the most efficiency, the closer Ect to 1, the higher the overall efficiency; f is the quantity involved in the calculation (NPV, CPV, IRR...); n is the quantity involved in the calculation.

III. RESULTS AND DISCUSSIONS

3.1. Status of agro-forestry production

The total natural area of the district is 173,808.39 ha, in which agricultural land is 169,064.58 ha (97.7%), non-agricultural land and bared land is 2.3% (Land survey of Con Cuong district, August 2016).

Table 1. The main plants in the studied areas

No.	Plants' name	Gender	Total area (ha)	Productivity (quintal/ha)
1	Rice	Bac thom, DT66, Khang dan 18, Q5, Sticky N97, LC25, NA2	4.450	51,8
2	Maize	Hybrids maize 30I87, AG69, C919, NK4300...	2.245	43,47
3	Tea		354,58	123
4	Orange	Orange type V_2	318	110
5	Cassava	TC1, KM94, KM60, KM95, HM124, KM124, NA1	1.715	240
6	Sugarcane	KK3, ROC10, ROX22, Viet duong 02336	277,8	604,7
7	Forest trees	Acacia mangium, Melia azedarach	20.000	

Source: Land survey of Con Cuong district, August 2016

As a result, the total land area are used for planting agricultural crops (rice, maize, cassava) still occupies the majority while the area reserved for industrial crops (tea, orange, sugarcane) is still limited. Generally, it has not changed the way of pure agriculture and no research on the efficiency of industrial crops.

3.2. Some main LUTs in the studied area

LUTs in the studied area are generally stable in the structure of household economy, land fund of the locality. LUTs has been arranged intermittently to form farm-level LUTs in the direction of developing commodity production.

Table 2. Main LUTs in Con Cuong district

No.	LUTs	Sub-LUTs/main plants	Position
1	Specialized rice (LUT1)	Two rice crops	Low-lying terrain, irrigation water ensure
2	Rice - Vegetables (LUT2)	Rice, vegetables, beans, maize, potatoes...	Foot hill, high ground, water shortage
3	Perennial and fruit plants (LUT3)	Orange type V_2, Tea	Hills, rocky mountains
4	Medicinal plants (LUT4)	Solanum procumbens, Lonicera japonica, Gymnema sylvestre	Rocky mountain, low hills
5	Forest trees (LUT5)	Acacia mangium, Melia azedarach	Hills

All communes have the similarity of natural conditions and the same LUTs. Nevertheless, there are different in area cultivation, cultivation intensity and crop practices. This study has selected a number of major LUTs occupying large areas and bringing high economic efficiency in the studied area including: (i) medicinal plants; (ii) specialized rice; (iii) hybrid maize; Acacia mangium and (v) Orange type V_2.

3.3. The efficiency of main LUTs in the studied area

Land use efficiency evaluation of LUTs plays an extremely important for selecting highly effective LUTs to apply for the other place in the district.

3.3.1. Economic efficiency

Economic efficiency is an essential measure to evaluate and to select productions by producers. The economic efficiency of LUTs is assessed through the income and cost of each LUT. In which the LUTs of orange type V_2, Acacia mangium are calculated by the dynamic method with the discount rate calculating at the interest rate of 10% per year.

Table 3. Economic efficiency of LUTs for agricultural and short-term medicinal plants

(Unit: million VND)

No.	Categories	LUTs				
		Solanum procumbens	**Gymnema sylvestre**	**Lonicera japonica**	**Rice + Maize hybrids**	**Rice**
1	Cost	149,3	173,15	160,15	34,21	40,46
2	Income	360,0	525	1.500	85,6	77,00
3	Benefit	210,7	351,85	1.339,85	51,39	36,54
	Rating	**3**	**2**	**1**	**4**	**5**

Athough Lonicera japonica is a new species planted in the studied area, it gives the highest income compared to the five short-term plants. With the investment cost of 160,150,000 VND/ha/year, the revenue is 1,500,000,000 VND/ha/year and the benefit reaches 1,339,500,000 VND/ha/year.

Gymnema sylvestre is also a new plant species which applied to grow in some communes. This species has good characteristics such as fast growth, harvesting time from 8 months to 10 months. Average planting density is 25,000 trees/ha, average productivity is 15 tons/ha/year, average price is 35,000 VND/kg, the income is 525,000,000 VND and the profit reaches 351,850,000 VND/year.

Solanum procumbens bring high economic value. Specifically, this species is ranked the third in the three medicinal plants and the third species in the five shorter-growing species in the studied area. Solanum procumben is fast growing plant with a density of 20,000 trees per hectare and harvesting time is from 8 months to 11 months. Because it has hard thorns, the labour cost is higher and the selling price is lower than the other two species with 24,000 VND/kg. Besides, the annual profit is lower than the Lonicera japonica and Gymnema sylvestre with 210,700,000 VND/ha/year.

Rice + hybrid maize: Maize is a species that was planted for a long time in the communes on bare soil and one rice crop. Spring rice crop is grew on the bare soil with water supply. The cost of rice + hybrid maize is 34,210,000 VND/ha, the turnover is 85,600,000 VND/ha and the profit is 51,390,000 VND/ha. In general, the income from the LUT is higher than that of two rice crops but it is lower than that of the three medicinal plants among five crops.

Two-crop rice cultivation: Average yield of rice is 40 - 45 quintals/ha/crop. The average cost is 40,460,000 VND/ha. The price of rice varies from 5,000 VND to 6,000 VND/kg. The average revenue per one ha of two-crop rice is 77,000,000/ha/year, and its benefit is about 36,540,000 VND/ha/year.

From 2015, the LUT of perennial plants in the studied communes has been expanded and brought a high efficiency (People's Committee of Con Cuong district, 2016). Because not only does this model exploit the land resources appropriately, but also improve the livelihoods of local people due to its high economic value.

Table 4. Economic efficiency of perennial crops

(Unit: VND)

Economic indices	LUT	
	Orange type V_2 (10 years)	Acacia mangium (7 years)
r	10%	10%
NPV	1,028,468,766	30,354,793
CPV	215,059,359	23,526,810
BPV	1,243,520,125	53,881,602
IRR	101.73	29
BCR (time)	5.75	2.9
NPV/year	85,705,730	2,529,566
Rating	**1**	**2**

The results show that both LUT of orange type V_2 and Acacia mangium are profitable. Their NPV value are 1,028,468,766 VND and 30,354,793 VND respectively. However, LUT of orange type V_2 is highly profitable. It is higher 40 times (average profit reached 85,705,730 VND/year) than LUT of Acacia mangium (average profit reached 2,529,566 VND/year). In addition to income from fresh produce, this variety has been utilized to produce essential oils and jam resulting in improving an average income.

Moreover, orange type V_2 and Acacia mangium are the potential plants with commercially viable, secure and profitable, as shown by BCR values of 5.75 and 2.9 times respectively. On the other hand, the internal rate of return (IRR) of the two LUTs is higher than the discount rate (r = 10%) so the production process is profitable. Orange type V_2 has a higher rate of recovery than that of Acacia mangium. In addition, during the first three years, people have shifted with short-term agricultural crops such as maize, peanuts, vegetables to revolve capital and self-sufficient food.

3.3.2. Social benefits

Social benefit assesses the social situation in the community because it reflects the level of acceptance of local people. A LUT is accepted by not only for high economic efficiency, regular income but also effective worker uses and goods production development (Do Van Nha, Nguyen Thi Phong Thu, 2016). Some indicators were used to assess the social benefit of LUTs such as the level of attracting labours, the number of products and the level of relevance to the farmer's production capacity, level and science and technology application.

Table 5. Social benefits of common LUTs in the studied area

Evaluation indices	Rice	Hybrid maize	Solanum procumbens	Gymnema sylvestre	Lonicera japonica	Orange type V_2	Acacia mangium
Low investment	8	9	5	5	5	5	7
Simple cultivation technique	8	8	7	7	7	6	8
Consistent with customs	10	10	8	8	8	8	8
Economic income	8	8	6	6	6	8	7
Products sold high prices, consume easily	6	6	10	10	10	10	10
Harvest products fast	8	8	8	8	8	6	5
Job solution	5	6	10	10	10	10	9
Application possibility	4	5	9	9	9	8	8
Commodity production ability	5	5	10	10	10	9	7
Overall score	**62**	**65**	**73**	**73**	**73**	**70**	**69**
Rating	**4**	**5**	**1**	**1**	**1**	**2**	**3**

The results showed that the LUT of medicinal plants (Hybrid maize, Solanum procumbens, Lonicera japonica) were ranked the first. The second, third, fourth and fifth were orange type V_2, Acacia mangium, rice, hybrid maize, respectively (see Tables 5, 6). LUTs of medicinal plants and orange type V_2 are the highest social benefit model with ability of solving 275 workers/ha/year and 240 workers/ha/year, respectively. These LUTs also bring high income and high consumption market while the others bring the local people lower income (see Table 6). However, rice and maize are important plants to ensure food security and products associated with traditional cultivation practices (50 - 60%). Therefore, these LUTs still need to be maintained. Measures need to be taken to improve the efficiency of land use and living standards for the local people.

Thus, the conversion of cultivation structure from rice, maize, vegetables... to medicinal plants, orange type V_2 has attracted labours involved and brought great economic value.

Table 6. Social benefit of LUTs in the studied area

No.	Index	Medicinal plants	Rice + hybrid maize	Two-crop rice	Orange type V_2	Acacium mangium
1	Credit use (credit/ ha/year)	275	100	90	240	130
2	Products number	3	2	1	3	2
3	People's acceptable (%)	45	50	60	45	70

3.3.3. Environmental benefits

The studied results indicate the perception of local people about LUTs impact on the ecological environment. Some indicators are used to access environmental benefits including: (i) darker soil colour (rapid assessment of humus content, soil moisture), (ii) improved soil texture, (iii) increased soil fertility, (iv) the quantity and quality of irrigation water, (v) increase/decreases the soil acidity, and (vi) increases/decreases crop productivity.

Table 7. Environmental benefits of common LUTs in the studied area

LUTs	Indicators							
	Darker soil color	Soil moisture	Soil texture	Quantity and quality of irrigation water	Soil acidity	Crop productivity	Overall score	Rating
Rice	0	0	0	0	-1	0	-1	4
Rice & hybrid maize	0	1	0	0	0	1	2	3
Solanum procumbens	0	1	0	1	0	1	3	2
Lonicera japonica	0	1	0	1	0	1	3	2
Gymnema sylvestre	0	1	0	1	0	1	3	2
Orange type V_2	1	1	0	1	0	1	4	1
Acacium mangium	1	1	0	1	0	1	4	1

The results show that environmental benefit of Orange type V_2 and Acacium mangium is higher than the others because most of the environmental indicators are constant and increased by time (see Table 7). In these LUTs, famers have implemented green manure, manure supplied to the soil during the annual soil cultivation so that soils increase humus content as well as activities of soil microorganisms (Schroth and Sinclair, 2003). In addition, the use of ingredient material such as lifeless parts of bean or peanut for covering oranges' stump help protect soil moisture, soil texture, soil nutrient content as well as decrease soil erosion (Nguyen Thi Cam My, 2010).

LUT of rice is the most effective LUT on soil environment due to annual acidity increase which is original from chemical fertilizers and pesticides. LUTs of rice and hybrid maize have been improved by using organic fertilizers, de-acidity by lime sprinkle.

Figure 1. Soil protection by using coverage in LUT of Gymnema sylvestre

Figure 2. Annamite insect pecking on orange trees in Yen Khe

3.3.4. Overall efficiency

The overall efficiency of LUTs is an important basis for selecting appropriate LUTs that are appropriate to local conditions and cultivation practices. This indicator is accessed based on the harmonious combination of economic index, social index, environmental index and sustainable development of agriculture.

Evaluation method (Etc) of Walfredo Ravel Rola's (1994) was applied to evaluate the composite effects of studied LUTs.

Table 8. Overall efficiency of LUTs at the studied site

No.	Index	X optimal		Rice		Rice & hybrid maize		Gymnema sylvestre		Lonicera japonica		Solanum procumbens		Orange type V_2		Acacia mangium	
		Type	Value	Value	Etc	Value	Etc	Value	Etc	Value	Etc	Value	Etc	Value	Etc	Value	Etc
1	*Economic index*				0.03		0.04		0.26		1		0.16		1		0.8
	NPV	Max	1,028.47											1,028.47	1	30,354	0.03
	BCR	Max	5.75											5.75	1	2.9	0.5
	IRR	Max	101.73											101.73	1	29	0.29
	Benefit	Max	1,339.85	36.54	0.03	51.39	0.04	351.85	0.26	1,339.85	1	210.7	0.16				
2	*Social index*	Max	73	62	0.85	65	0.89	73	1	73	1	73	1	70	0.96	69	0.95
3	*Environment index*	Max	5	-1	0.2	3	0.6	4	0,8	4	0.8	4	0.8	5	1	5	1
	Total Ect				**0.36**		**0.51**		**0.69**		**0.93**		**0.65**		**0.99**		**0.92**
	Rating				**7**		**6**		**4**		**2**		**5**		**1**		**3**

The studied results access that the LUT of orange type V_2 gives the highest overall efficiency with overall Ect of 0.99. In which, economic Etc is 1, social Etc is 0.96 and environmental Etc is 1. The social-ecological environment indices reach highly effective to meet the demand for sustainable development. The following are the LUTs of Lonicera japonica, Acacia mangium, Gymnema sylvestre, Solanum procumbens, Rice & hybrid maize and the last is Rice. Therefore, in the coming time, the People's Committee of Con Cuong district should have solutions on land planning to replicate high-efficiency models.

IV. CONCLUSIONS

In Con Cuong district, there are 5 common LUTs: (i) rice (LUT1), (ii) rice - vegetable (LUT2), (iii) perennial and fruit trees (LUT3), (iv) medicinal plants (LUT4) and (v) forest trees (LUT5).

Economic efficiency: To LUTs of short-term crops, the LUT of medicinal plants have the highest revenue with Lonicera japonica was profitable at 1,339,850,000 VND/ha/year, followed by Gymnema sylvestre with benefit of 351,850,000 VND/ha/year, Solanum procumbens reached 210,700,000 VND/ha/year. Rice & hybrid maize attained 51,390,000 VND/ha/year and LUT of rice only gave profit of 36,540,000 VND/ha/year. To LUTs of long-term crops, Orange type V_2 had NPV of 1,028,468,766 VND, Acacia mangium reached 30,354,793 VND. Besides, orange type V_2 had BCR, IRR of 5.75 and 101.73%, corresponding to Acacia mangium was 2.9 and 29%.

Social benefits: The LUT of medicinal plants (Solanum procumbens, Gymnema sylvestre, Lonicera japonica) was ranked the highest. The following LUTs were Orange type V_2, Acacia mangium, rice & hybrid maize and rice, respectively.

Environmental benefits: Acacia mangium and Orange type V_2 were evaluated higher LUTs in environmental assessment than the others due to the constant of environmental indices in the whole evaluation process.

Overall efficiency: The LUTs of orange type V_2 was determined to have the highest overall efficiency with Ect of 0.99. Specially, economic Etc is 1, social Etc is 0.96 and environmental Etc is 1. The following were the LUTs of Lonicera japonica, Acacia mangium, Gymnema sylvestre, Solanum procumbens, Rice & hybrid maize and Rice.

REFERENCES

1. Nguyen Thi Cam My (2010). *Research on impact of covering materials on growth & development of Tea species and soil characteristics in Phu Ho commune, Phu Tho province*. MSc. thesis, Thai Nguyen University.

2. Nguyen Minh Thanh, Tran Thi Nham (2015). Accessment efficiency of agro-forestry land use types in Cao Ky commune, Cho Moi district, Bac Kan province. *Soil Science Journal*, No. 46/2015.

3. People's Committee of Con Cuong district (2016). *Assessing the performance of tasks in 2016 and some objectives, tasks and solutions to implement the 2017 plan.* People's Committee of Con Cuong district, Nghe An province.

4. FAO (1994). *Land evaluation and farming system analysis for land and use planning.* Working document, Rome.

5. Schroth, G. and Sinclair, F. L. (2003). *Trees, Crops and Soil Fertility: Concepts and research methods.* CABI Publishing.

ĐÁNH GIÁ HIỆU QUẢ SỬ DỤNG ĐẤT NÔNG NGHIỆP TRÊN ĐỊA BÀN HUYỆN CON CUÔNG, TỈNH NGHỆ AN

Nguyễn Minh Thanh[1], Nguyễn Thị Bích Phượng[2], Bùi Nhật Hùng[3]

[1,2,3]Trường Đại học Lâm nghiệp

TÓM TẮT

Sử dụng đất bền vững, tiết kiệm và có hiệu quả đã trở thành chiến lược quan trọng có tính toàn cầu. Chiến lược sử dụng đất nông nghiệp đóng vai trò rất quan trọng đối với vùng nông thôn Việt Nam bởi nó quyết định việc tạo ra các sản phẩm nông nghiệp và sản phẩm nông nghiệp hàng hóa cũng như ảnh hưởng lớn đến đời sống của người dân địa phương. Kết quả nghiên cứu trên 3 xã thuộc huyện Con Cuông, tỉnh Nghệ An cho thấy các mô hình sử dụng đất nông nghiệp đã và đang chuyển đổi mạnh mẽ theo hướng sử dụng đất hiệu quả và bền vững. Nghiên cứu đã chỉ ra rằng có 5 mô hình sử dụng đất chính trên địa bàn huyện. Trong đó, mô hình sử dụng đất trồng cây dược liệu, Cam V_2 cho hiệu quả về mặt kinh tế cao nhất, lợi ích môi trường và xã hội. Các mô hình mang tính nông nghiệp thuần túy (lúa, ngô) tuy không mang lại hiệu quả kinh tế cao nhưng đóng vai trò quan trọng trong việc duy trì lối canh tác truyền thống và đảm bảo an ninh lương thực cho người dân địa phương. Kết quả nghiên cứu là cơ sở quan trọng cho việc đề xuất định hướng và sử dụng đất nông nghiệp mang tính hiệu quả cao và bền vững cho địa phương.

Từ khoá: Cây dược liệu, Con Cuông, chiến lược sử dụng đất, hiệu quả kinh tế, mô hình sử dụng đất.

Received : 01/3/2018
Revised : 27/3/2018
Accepted : 02/4/2018